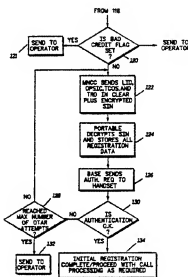
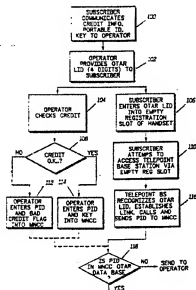




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/US91/05495 (22) International Filing Date: 2 August 1991 (02.08.91) (30) Priority data: 635,405 31 December 1990 (31.12.90) US (71) Applicant: MOTOROLA, INC. [US/US]; 8000 West Sunrise Blvd., Ft. Lauderdale, FL 33322 (US). (72) Inventors: D'AMICO, Thomas, V.; 2707 N. Ocean Boulevard, Boca Raton, FL 33431 (US). SHARP, Ronald, E.; 1251 N.W. 78th Terrace, Plantation, FL 33322 (US). (74) Agents: NICHOLS, Daniel, K. et al.; Motorola, Inc., Intellectual Property Dept., 8000 West Sunrise Boulevard, Fort Lauderdale, FL 33322 (US).		(81) Designated States: AT (European patent), AU, BE (European patent), BR, CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FI, FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), NO, SE (European patent). Published <i>With international search report.</i>

(54) Title: SECURE OVER-THE-AIR REGISTRATION OF CORDLESS TELEPHONES**(57) Abstract**

A method of registration of a portable unit that may be utilized in a communication system that comprises a network controller, having a data base for storing portable identification numbers, a base station, and a portable unit, wherein a subscriber communicates to the network controller a first information set which comprises subscriber qualifying information, the portable identification number, and a key code that has been entered into the portable (100), and wherein the subscriber has entered a link identification number for over-the-air registration into a memory within the portable unit (102).

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SECURE OVER-THE-AIR REGISTRATION OF CORDLESS TELEPHONES

10 Technical Field

This invention relates generally to public cordless telephone systems.

Background

- 15 Cordless telephone communication systems generally comprise a plurality of public base stations (also called telepoints) that may be used by any subscribers within range. In the future such public base stations may become as common as public telephones are today. When in range, a subscriber will be able to
- 20 access the public switched telephone network (PSTN) and place a call. However, registration of a cordless handset into a cordless telephone system presents some problems. There is an expected delay from the time that a customer buys a cordless handset (also known as a portable communication unit, or simply a portable
- 25 unit) until the customer receives access to the cordless telephone system from the network operator. This delay is generally used for checking the subscriber's credentials such as available credit or other qualifying information. Since the portables store all registration data, there is a need to load this data at a convenient
- 30 time and location after the credit check is completed. In cellular systems on-line validation is used where a portable may be activated instantly at a central data base.

- The generation, delivery, and loading of the registration data is an arduous task. For, example, CT-2 requires the manual
- 35 entry of up to 67 characters (including all check digits). Reduction or elimination of this manual entry is highly desirable.

Summary of the Invention

Briefly, according to the invention, a method for registration of a portable unit may be utilized in a communication system that comprises a network controller, having a data base for storing portable identification numbers, a base station, and a portable unit, wherein a subscriber communicates to the network controller a first information set which comprises subscriber qualifying information, the portable identification number, and a key code that has been entered into the portable, and wherein the subscriber has entered a link identification number for over-the-air registration into a memory within the portable unit. The registration method comprises the following steps. The portable unit sends the base station a request for registration. The request for registration comprises the link identification number for over-the-air registration and the portable identification number. The base station receives the request for registration from the portable unit, and sends to the network controller a notice of the request for registration and the portable identification number. The network controller receives the notice of the request for registration from the base station, and determines whether the portable identification number is in the network controller data base, and whether the subscriber has been approved for registration. The network controller then sends to the portable unit, through the base station, a registration information signal if the network controller determines that the portable identification number for over-the-air registration is in the network controller data base, and that the subscriber has been approved for registration. The registration information signal comprises an encrypted subscriber identification number that has been encrypted with the key code, and an unencrypted link identification number for base station access.

Brief Description of the Drawings

Figure 1 shows a communication system in which the invention may be advantageously utilized.

Figure 2 shows a portable unit that may be adapted for use in accordance with the invention.

Figure 3 shows a base station that may be adapted for use in accordance with the invention.

Figures 4a and 4b, show a simplified block diagram of a portable unit registration process in accordance with the invention.

Figures 5a and 5b show a method for re-registration of a subscriber unit.

Detailed Description of the Preferred Embodiment

Referring to Figure 1, a communication system 10 in which the invention may be advantageously utilized is shown. The system 10 comprises a network controller 12, a base station 14, and a portable unit 16.

Referring to Figure 2, there is shown a portable unit 16 that may be adapted for use in accordance with the invention. The portable unit 16 comprises an antenna 18, a transmit /receive switch 20, a radio-frequency receiver 22, a radio-frequency transmitter 26, a controller 24 (e.g., a conventional microcomputer), a memory 28 (e.g., a read only memory and/or a random access memory), a speaker 30, and a microphone 32 all coupled as shown in the Figure 1. The portable unit 16 may be adapted to operate in accordance with the invention by programming the controller 24 to use the portable unit registration and re-registration processes of the invention.

Referring to Figure 3, there is shown a base station 14 that may be adapted for use in accordance with the invention. The base station 14 comprises an antenna 34, a transmit /receive switch 36, a radio-frequency receiver 38, a radio-frequency transmitter 44, a controller 40 (e.g., a conventional microcomputer), a memory 42 (e.g., a read only memory and/or a random access memory), all coupled as shown in the Figure 2.

Referring to Figure 4a, there is shown a simplified block diagram of a portable unit registration process in accordance with the invention. In a preferred embodiment, a key code is loaded into the portable unit during manufacture, and printed in a sealed envelope. The subscriber then only needs to read the key code to the network operator (possibly during a wireless telephone conversation). Manual entry of a key code may be used as a back-up method in case that (1) the subscriber loses the envelope, or (2) the registration slot has previously been used and the network operator changed the key code. The registration process may begin at the time that a person buys a portable 16, and the portable unit dealer (or the customer) loads a key code in the portable unit 16. The secret key code may also be generated by a network operator along with a check character to maximize correct entry of the key code. Alternately, the portable unit dealer could generate the key code, provided that a high degree of randomness is assured, and a check digit or other known means is used to minimize entry errors. A network operator receives all customer credential data (in this exampled these data relate to the subscriber's credit), and the secret key code (if the key code is dealer-generated).

According to step 100, a subscriber, seeking registration in the communication system, communicates his or her qualifying credentials (e.g., credit information) to the network controller. The communicated information may comprise a portable unit serial number, and a secret key code that is used to encrypt and decrypt secure registration data. In step 102, the network operator provides a link identification number to the subscriber. The link identification number comprises four digits and is used for specific telepoint access. In step 104, the network operator (and the network controller) determine whether the credit information provided by the subscriber complies with a set of criteria used for qualifying the subscriber (in this example: whether the subscriber's credit is adequate). In decision 108, if the credit information of the subscriber complies with the qualifying criteria, the network operator enters a portable identification number, and

a 64 bit secret key code into the network control center (which is preferably within the network controller). If the credit information relating to the subscriber does not comply with the qualifying criteria of step 112, the operator enters the portable identification number, and an invalid flag into the network control center.

According to step 110, the subscriber attempts to access a telepoint base station via a registration slot having the link identification number. Then according to step 116, the telepoint base station recognizes the over-the-air link identification number, establishes a communication link, and calls and sends the portable identification number to the network control center. In decision 118, the network controller determines whether the portable identification number is in the network controller center over the air database. If it is not, then the portable identification number is sent to the operator and the network controller.

Referring to Figure 4b, if the network controller determines that the portable identification number is in the database, then a further decision 120 is made relating to whether there is a valid/invalid flag set. If there is a invalid flag set, that information is sent to the operator, and the network controller. If a valid flag is found, the network controller sends the link identification number, the nine-bit operator's identification code number, the three-bit telepoint class of service number, and the 20 bit digit telepoint registration data field to the portable unit in unencrypted form. In addition, the network controller sends the portable an encrypted subscriber identification number that has been encrypted with the key code for that portable unit. Next, in step 124 the portable unit decrypts the subscriber identification number, and stores all registration data in its memory. In step 126, the base station sends an authentication request to the portable unit. Once the portable unit receives the authentication request and responds thereto, the base station makes a decision 130 on whether the received authentication response signal is valid. If the authentication response signal is valid the initial registration is completed in step 134 and call-processing may proceed, as required. On the other hand, if the authentication response signal

is not valid, then a decision 128 must be made on whether a maximum number of over-the-air registration attempts has been made. If the maximum number of over-the-air attempts is reached, then step 132 requires that the operator in the network controller be so notified. If the maximum number of over-the-air attempts has not been reached, then the process returns to step 122.

A registration method similar to the above-discussed method allows for immediate registration. The steps are as follows. The subscriber locates a base station and attempts to register. The base station recognizes the the registration attempt, and contacts the network controller which checks its data base for a valid flag. If the valid flag is not found, the subscriber is connected to a network operator "help desk." Alternatively, the subscriber could manually place a free call to the network operator "help desk." No registration would be required for this kind of call.

Upon receipt of a credit card charge number or other credit approval, the network operator "help desk." provides the subscriber with a key code and a check character to enter with a keypad. Simultaneously or immediately thereafter, the network controller receives the portable identification number from the base station and downloads the key code and all registration data to that base station. The subscriber may then register over the air in a secure data mode as in the above-described method.

Referring to Figure 5a, there is shown a method for re-registration of a subscriber unit. In step 200 a registered subscriber accesses a telepoint base station. Then according to step 202, the telepoint base station accessed by the subscriber recognizes a re-registration need, possibly due to a compromise of the authentication or registration algorithm stored in the portable. Then the telepoint base station calls the network controller, and informs it of this fact. In step 204 the portable unit sends a set of random numbers to the telepoint base station. The base station then receives and retransmits the random numbers to the network controller which, in step 206, encrypts the current

subscriber identification number with the random numbers and sends that resulting encrypted subscriber identification number to the portable unit. In step 208, the portable unit decrypts the received encrypted subscriber identification number, and checks
5 for a match with a current subscriber identification number.

Referring to Figure 5b, if (in decision 210) a match is determined to exist (shown in Figure 5a), the portable unit will act upon subsequently received registration data. Then in step 212, the network controller encrypts a new secret key code and new
10 subscriber identification number, and sends all registration data to the portable unit. Then in step 214, the portable unit decrypts the new secret key code, the new subscriber identification number, and places all that data in a temporary storage portion of the handset memory. Next in step 216 the base station sends an
15 authentication request to the portable unit. The portable unit receives the authentication request, and responds thereto. The base station then makes a decision 220 on whether the authentication response is valid. If it is not valid, then a decision 218 is made on whether a maximum number of registration
20 attempts has been reached. If the maximum number of registration attempts has been reached, the operator is notified in step 219. On the other hand, if the maximum number of registration attempts has not been reached, the process returns to step 204. In the event that the authentication response is valid, in
25 step 222 the portable unit detects the authentication response and stores all registration data in a selected registration slot in the portable unit memory. In step 223, re-registration is completed, and call-processing proceeds, as required.

The base station and the network controller perform the
30 basic infrastructure functions. While in the preferred embodiment infrastructure functions have been specifically allocated among the base station and the network controller, those functions may be interchanged between them.

35 What is claimed is:

Claims

1. In a communication system comprising a network controller, having a data base for storing portable identification numbers, a base station, and a portable unit, wherein a
5 subscriber communicates to the network controller a first information set which comprises subscriber qualifying information, the portable identification number, and a key code that has been entered into the portable, and wherein the
10 subscriber has entered a link identification number for over-the-air registration into a memory within the portable unit, a method for registration of the portable unit, comprising the steps of:

at the portable unit:

- (a) sending the base station a request for registration, the
15 request for registration comprising the link identification number for over-the-air registration and the portable identification number;

at the base station:

- (a) receiving the request for registration from the portable
20 unit, and sending to the network controller a notice of the request for registration and the portable identification number;

at the network controller:

- (a) receiving the notice of the request for registration from
25 the base station, and determining whether the portable identification number is in the network controller data base, and whether the subscriber has been approved for registration;
(b) sending, to the portable unit through the base station, a
registration information signal when the network controller
30 determines that the portable identification number for over-the-air registration is in the network controller data base, and that the subscriber has been approved for registration, the registration information signal comprising an encrypted subscriber
identification number that has been encrypted with the key code,
35 and an unencrypted link identification number for base station access.

2. The method for registration of the portable unit of claim 1, further comprising the steps of:

5 at the portable unit:

 (b) receiving the registration information signal sent by the network controller, decrypting the encrypted subscriber identification number, and placing the information in the registration information signal in temporary storage;

10 and

 (c) receiving the authentication request from the base station;

 (d) sending an authentication response to the base station;

15 (e) receiving the notification signal from the base station and maintaining the information in the registration information signal in long term storage;

 at the base station:

20 (b) sending an authentication request to the portable unit;

 (c) receiving the authentication response from the portable unit, determining whether the authentication response is valid, and sending a notification signal to the portable unit when the authentication response is valid.

25

3. The method for registration of the portable unit of claim 2, further comprising the step of:

 at the network controller:

 (a 1) encrypting the subscriber identification number.

30

4. The method for registration of the portable unit of claim 2, further comprising the step of:

 at the base station:

 (a 1) encrypting the subscriber identification number.

5. In a communication system comprising a network controller, having a data base for storing portable identification numbers, a base station, and a portable unit, wherein a subscriber communicates to the network controller a first information set which comprises subscriber qualifying information, the portable identification number, and a key code that has been entered into the portable, and wherein the subscriber has entered a link identification number for over-the-air registration into a memory within the portable unit, and wherein the portable unit has been registered in the communication system, a method for re-registration of the portable unit, comprising the steps of:

at the base station:

- (a) recognizing the need for re-registration of the portable unit, and transmitting a notification of the need for re-registration to the network controller;
- (b) sending an authentication request to the portable unit;
- (c) receiving the set of random numbers from the portable unit and sending the set of random numbers to the network controller;

at the network controller:

- (a) receiving the notification of the need for re-registration;
- (b) receiving the set of random numbers from the base station, encrypting the current subscriber identification number with the set of random numbers; and sending the encrypted subscriber identification number to the portable unit through the base station;

at the portable unit:

- (a) receiving the authentication request from the base station;
- (b) sending a set of random numbers to the base station;
- (c) receiving the encrypted subscriber identification number, decrypting the encrypted subscriber identification

number, determining whether the resulting decrypted subscriber identification number matches the current subscriber identification number, and when the resulting decrypted subscriber identification number matches the current subscriber identification number responding to any re-registration data subsequently sent by the base station.

6. The method for re-registration of the portable unit of claim 5, further comprising the steps of:

at the portable unit:

- (d) decrypting the new subscriber identification number,
5 and storing the decrypted new subscriber identification number.

at the network controller:

- (c) encrypting a new subscriber identification number and
sending the new subscriber identification number to the portable
10 unit, through the base station, when the decrypted subscriber
identification number sent by the portable unit matches the
current subscriber identification number;

7. The method for re-registration of the portable unit of claim 6, further comprising the steps of:

at the base station:

- 5 (d) sending an authentication request to the portable unit;
(e) receiving the authentication response from the portable unit, determining whether the authentication signal is valid, and sending a notification signal to the portable when the authentication response is valid;

10

at the portable unit:

- (e) receiving the authentication request, and sending an authentication response to the base station.

15

8. The method for re-registration of the portable unit of claim 7, further comprising the steps of:

at the network controller:

- (d) encrypting a new key code and sending the new key code to the portable.

20

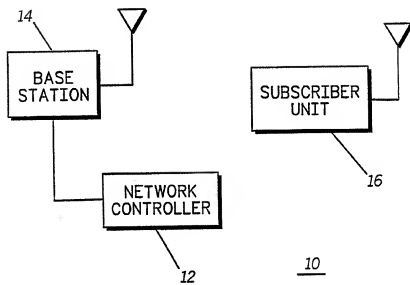
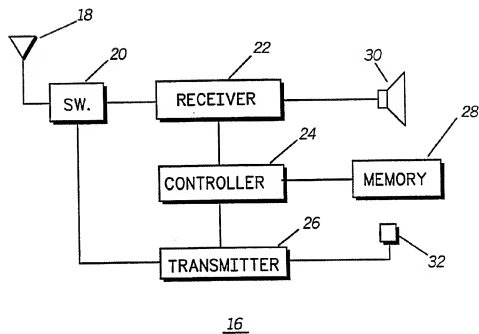
9. The method for re-registration of the portable unit of claim 8, further comprising the steps of:

at the network controller:

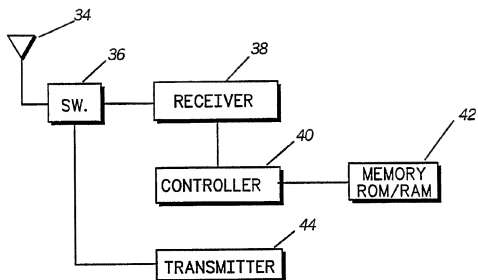
- 25 encrypting any new subscriber identification numbers to be sent to the portable unit when a new key code is to be sent.

10. In a communication system comprising a network controller, having a data base for storing portable identification numbers, and a base station, wherein a subscriber communicates to the network controller a first information set which comprises
- 5 subscriber qualifying information, the portable identification number, and a key code, a portable unit comprising:
- means for sending the base station a request for registration, the request for registration comprising a link identification number for over-the-air registration and the portable
- 10 identification number;
- means for receiving registration information signal sent by the network controller;
- means for decrypting an encrypted subscriber identification number.

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*FIG. 1**FIG. 2*

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***FIG. 3***

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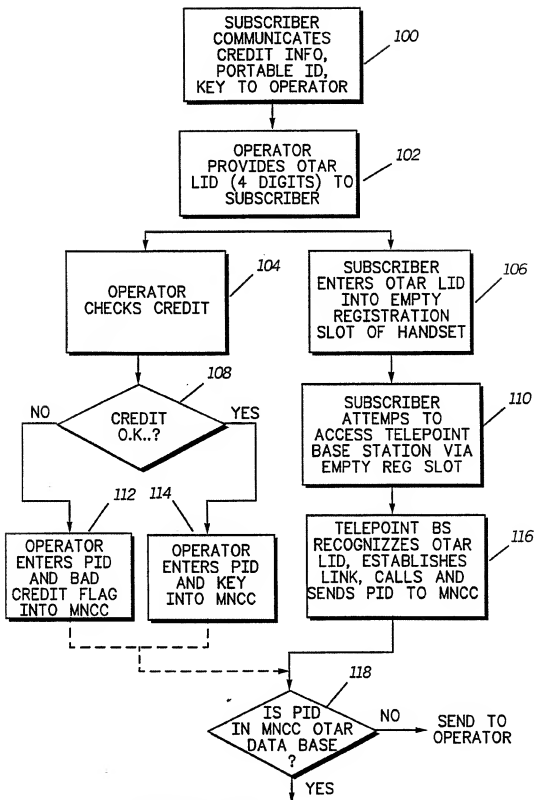


FIG. 4a

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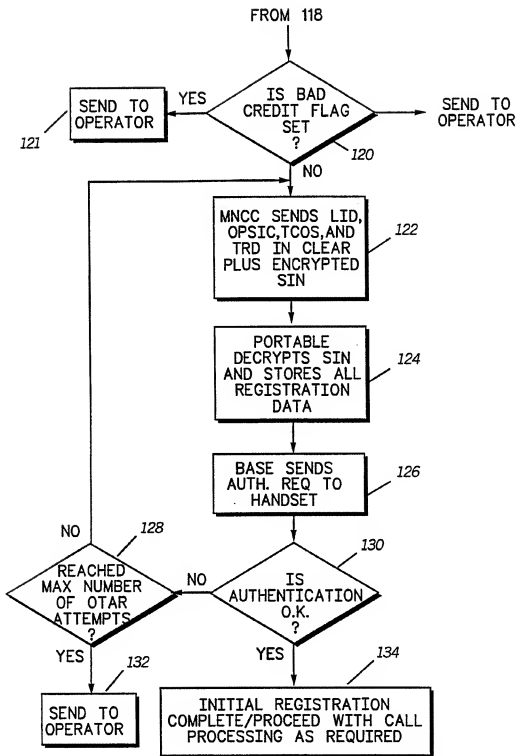
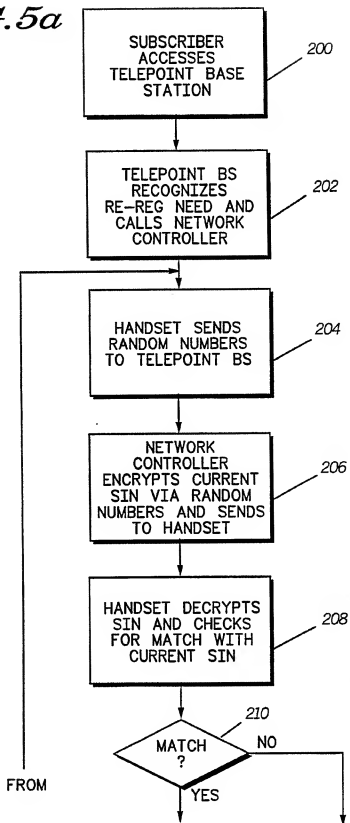
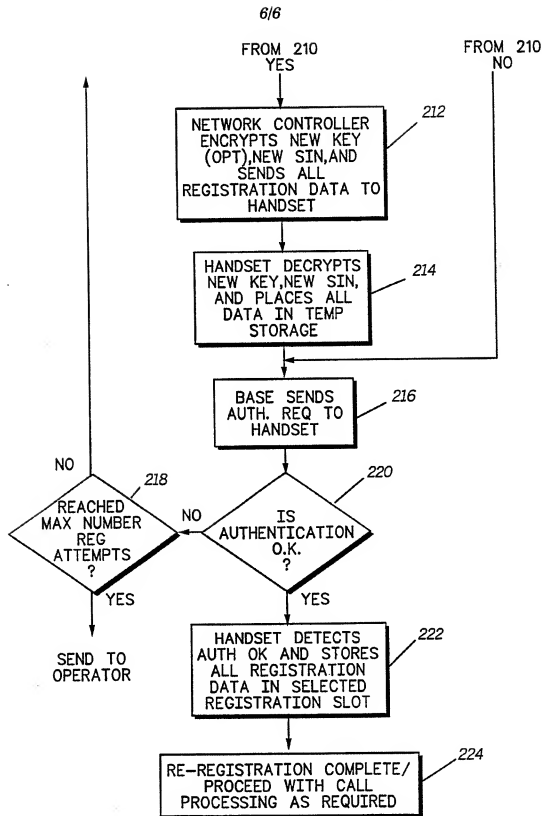


FIG. 4b

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FIG. 5a

*FIG. 5b*

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US91/05495

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC IPC(5): H04K 1/00; H04M 11/00 US CL: 380/23; 379/62		
II. FIELDS SEARCHED		
Minimum Documentation Searched *		
Classification System	Classification Symbols	
US	380/23; 379/62	
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched *		
III. DOCUMENTS CONSIDERED TO BE RELEVANT *		
Category *	Citation of Document, ¹⁾ with indication, where appropriate, of the relevant passages ²⁾	Relevant to Claim No. ³⁾
A	US, A, 4,811,377 (KROLOPP ET AL.) 07 MARCH 1989	1-10
A	US, A, 4,654,481 (CORRIS ET AL.) 31 MARCH 1987	1-10
A	US, A, 4,574,163 (ZATO) 04 MARCH 1986	1-10
A	US, A, 4,560,832 (BOND ET AL.) 24 DECEMBER 1985	1-10
<p>* Special categories of cited documents: ⁴⁾</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document not published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principles or theory underlying the invention</p> <p>"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>4. document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of this International Search	Date of Mailing of this International Search Report	
14 JANUARY 1991	02 MAR 1992	
International Searching Authority	Signature of Authorized Officer	
ISA/US	David C. Cain	

IN THE UNITED STATES RECEIVING OFFICE

Applicant: Motorola, Inc.
Inventors: D'Amico, et al
International Application No.: PCT/US91/05495
International Filing Date: 2 August 1991
Docket No.: CM00967J (PCT)
For: SECURE OVER-THE-AIR REGISTRATION OF CORDLESS
TELEPHONES

24 March 1992

REQUEST FOR RECTIFICATION OF OBVIOUS ERROR

Honorable Commissioner of Patents and Trademarks,
Washington, D.C. 20231
Box PCT

Dear Sir:

Pursuant to PCT Rule 91 the Applicant hereby requests that the Receiving Office rectify an error in claiming priority in the Request for Processing of the above-captioned International Application under the Patent Cooperation Treaty (hereafter, the Request) by adding a reference to United States Application No. 562,356 having a filing date of 3 August 1990, in space (2) of Box No. VI of the Request.

REMARKS

Applicants have discovered an error in the priority claim in Box No. VI of the Request. The priority claim refers to U.S. Application Number 643,405 and states that the filing date was 31 December 1990. The actual priority date should be 3 August 1990 which is the filing date of the parent U.S. application (No. 562,356). Therefore, Box No. VI of the Request should be corrected to include reference to United States Application No. 562,356 having a filing date of 3 August 1990. The omission of this reference is believed to be an obvious error because the Transmittal Letter for the subject Request states at item 4 that the prior application (No. 635,405) was filed on 3 August 1990, and under 35 USC §120 the effective date for Application No. 635,405 is 3 August 1990. Moreover, Applicant filed the International Application on 2 August 1991 to comply with the one-year requirement considering a filing date of 3 August

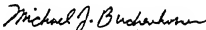
1990. Thus, it is obvious that Applicant Intended to claim priority based on the filing date of the parent U.S. application.

PCT Rule 91.1 provides that obvious errors in the international application may be rectified with the express authorization of the Receiving Office. An obvious error is one which is due to the fact that something other than what was obviously intended was written in the international application. See PCT Rule 91.1(b). Therefore, Applicant respectfully submits that such express authorization be granted and that the obvious error be corrected.

PCT Rule 26.4(a) provides that any correction offered to the Receiving Office may be stated in a letter to that office if the correction is of such a nature that it can be transferred from the letter to the record copy without adversely affecting the clarity and the direct reproducibility of the of the sheet to which correction is to be transferred. Applicants believe that the inclusion of reference to U.S. Application No. 562,356 in space (2) of Box No. VI will not adversely affect the clarity and the direct reproducibility of the of the sheet to which correction is to be transferred. However, in the event that the Examiner disagrees, Applicant will gladly provide a substitute sheet with the subject correction.

Respectfully submitted,

MOTOROLA, INC.
Patent Department
8000 West Sunrise Blvd.
Ft. Lauderdale, Florida 33317


Michael J. Buchenhorner
Attorney for Applicant
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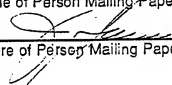
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Jerilyn Saccocio
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IN THE UNITED STATES RECEIVING OFFICE

Applicant: Motorola, Inc.
International Application No.: PCT/US91/05495
International Filing Date: 2 August 1991
Docket No.: CM00967J (PCT)
For: SECURE OVER-THE-AIR REGISTRATION OF CORDLESS TELEPHONES

26 March 1992

SUPPLEMENTAL SUBMISSION

IPEA/US
Box PCT
Commissioner of Patent and Trademarks
Washington, D.C. 20231

Dear Sir:

This submission is supplemental to the Request For Rectification of Obvious Error sent by Applicant to the USPTO Receiving Office on 26 March 1992 requesting that the Receiving Office rectify an error in claiming priority in the Request for Processing of the above-captioned International Application under the Patent Cooperation Treaty (hereafter, the Request).

At the suggestion of Attorney Charles Pearson, of the PTO International Division, Applicant is enclosing four substitute sheets of the Request. Note that substitute Sheet No. 5 includes an additional reference to U.S. Patent Application No. 562,356 (the Parent Application) which was abandoned in a File Wrapper Continuation Application (Serial No. 635,405) dated 31 December 1990 (the FWC Application).

Applicant respectfully submits that the Parent Application was identified by the reference to the FWC Application because the FWC Application is nothing more than an amendment of the Parent Application and both share the same file wrapper. As discussed in the Request for Rectification, Applicant's intent to

claim the 3 August 1990 priority date is evidenced by the indication of the 3 August 1990 as the filing date for the FWC Application. Therefore, the obvious error was in referring to the December 1990 date in Box VI of the Request, instead of the August 1990 date.

Applicant submits that the Request For Rectification is timely under Rule 91.1(gbis) if the technical preparations for publication have not been completed. The Notification of Receipt of the Record Copy indicates that the priority date is considered to be 31 December 1990. Thus, the International Bureau has probably not completed the technical preparations for publication. Therefore, Applicant respectfully requests that the Request For Rectification be treated with the greatest urgency.

In the event that this paper or the Request for Rectification require a fee, the Commissioner is hereby authorized authorized to charge any fees which may be required, or credit any overpayment to Account No. 13-4774. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

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